CHAPTER 5
CUMULATIVE IMPACTS

The most significant environmental effects may result not from the direct effects of a particular action, but from the combination of the minor effects of multiple individual actions over time (CEQ 1997b). The Council on Environmental Quality (CEQ) regulations implementing the procedural provisions of the *National Environmental Policy Act* (NEPA) define cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). The regulations further explain that "cumulative effects can result from individually minor but collectively significant actions taking place over a period of time."

5.1 METHODOLOGY

The cumulative impacts analysis presented in this document is based on the potential effects of the Tucson Electric Power Company (TEP) Sahuarita-Nogales Transmission Line Project when added to impacts from other actions in the region. The analysis in this chapter centers on the cumulative effects of past, present, and reasonably foreseeable future actions, and identifies where cumulative impacts may differ among the action alternatives evaluated in Chapter 4 (Western, Central, and Crossover Corridors). The potential effects are evaluated both for the period of project construction (anticipated to be 12 to 18 months), and for the post-construction (operation) period of the project.

The region of influence (ROI) varies for each resource area, depending on the geographic extent of a potential effect. For water and soil resources, the ROI comprises the watersheds described in Section 3.7, Water Resources; for biological resources, the ROI is the Sky Island Region as described in Section 3.3, Biological Resources; for land use, recreation, cultural, and visual, the ROI is the entire area (and viewshed) of the valleys and mountains between Tucson and Nogales, Arizona; for socioeconomics, the ROI is Pima and Santa Cruz Counties; for air quality, the ROI is the regional airshed in southern Arizona. The analysis contained in this chapter includes actions that could be reasonably anticipated to occur and have cumulative effects within the ROI. The cumulative impacts to air quality associated with development in the U.S-Mexico border area are included in the air quality cumulative impacts analysis. Following the discussion of potential cumulative impacts for each resource area for the entire ROI, potential cumulative impacts specific to the Coronado National Forest are discussed. Table 5.4-1 at the end of this chapter summarizes the cumulative impacts by resource area and notes the differences (if any) in cumulative impacts among the Western, Central, and Crossover Corridors.

5.2 REASONABLY FORESEEABLE ACTION IDENTIFICATION

The following potential actions have been evaluated to determine if they are reasonably foreseeable. Those actions determined to be reasonably foreseeable are included in the Section 5.3 analysis of cumulative impacts with this TEP Project.

5.2.1 Other Energy and Transmission Line Projects in Southern Arizona

Public Service Company of New Mexico. Several years ago, the Public Service Company of New Mexico (PNM) applied to the U.S. Department of Energy (DOE) for a Presidential Permit to construct an electric transmission line across the U.S.-Mexico border in Nogales, overlapping portions of the proposed TEP project. At approximately the same time, PNM submitted a special use application to the USFS Coronado National Forest requesting authorization to cross National Forest System lands in the Tumacacori EMA with its proposed transmission line. However, in October 2004, PNM indicated that it would be preparing a letter to the DOE withdrawing their Presidential Permit application. On November 16, 2004, PNM sent DOE a letter officially withdrawing their Presidential Permit application. As such,

PNM's proposed project is not considered to be a reasonably foreseeable action and is no longer included in the cumulative impacts analysis that follows. As DOE was also the lead Federal agency for environmental review of the PNM proposal, USFS accepts the termination of DOE's environmental review of the PNM proposal as constituting cancellation of PNM's special use permit application and no longer considers the PNM proposal to be a reasonably foreseeable action on National Forest System lands.

New or Expanded Power Plants in Southern Arizona. A database of proposed electric power generation expansion within the Western Electricity Coordinating Council (WECC) region (which includes Arizona) does not identify any proposed projects within Pima and Santa Cruz Counties that are in active planning or currently under construction. The status of the Ambos Nogales Generating Station (listed with Maestros Group as the project proponent) in Santa Cruz County is shown as "cancelled, denied permit, or delayed indefinitely." Therefore, the construction or expansion of power plants in Pima and Santa Cruz Counties is not reasonably foreseeable.

5.2.2 Industrial Development

The U.S.-Mexico border is a developing center of commerce. Currently, more than $1 billion of Mexican produce crosses the U.S.-Mexico border at Nogales bound for the United States and Canada each year, and approximately 1,300 trucks from Mexico enter Nogales everyday from November through May. The U.S. 1998 *Transportation Equity Act for the 21st Century* allocates funding for the development and improvement of high priority corridors, including the CANAMEX corridor leading north from the U.S.-Mexico border along Interstate 19 (I-19). In Federal Fiscal Year 2003, it is estimated that the CANAMEX states will receive on average an estimated $277 million per year per state. On the high end, it is anticipated that Arizona will receive $462 million per year for the development and improvement of high priority corridors (CANAMEX 2001). The State of Arizona has pledged additional funding. The development and improvement of this high priority corridor would involve roadway improvements that could lead to an increase in industrial parks, manufacturing facilities, and truck traffic, especially in Nogales, Arizona. On a larger scale, improved electricity reliability in the Nogales region would be expected to produce long-term socioeconomic benefits. A reliable electricity supply would support business development and regional growth, but is not quantified.

5.2.3 Trade Corridor/Roadway Development

In January 2000, the City of Nogales, Arizona initiated an engineering and cost Feasibility Study (City of Nogales 2000) for trade corridors in its vicinity. Two roadways were proposed:

- North-South Interconnector – A 7.3-mi (11.7-km) partially access-controlled expressway or super-arterial roadway connecting State Highway 189, in the vicinity of the U.S.-Mexico border, to I-19 at Ruby Road (including an upgrade of Ruby Road). This project was depicted in the feasibility study as a four-lane highway with a median in a 150-ft (46-m) ROW.

- East-West Interconnector – A 3.5-mi (5.6 km), five-lane arterial roadway connecting the proposed North-South Interconnector with State Route 82 in the vicinity of Business 19.

The Draft EIS included this project as a reasonably foreseeable project for cumulative impact analysis. However, since issuance of the Draft EIS, the Trade Corridor/Roadway Development project has been deferred indefinitely and is no longer considered a reasonably foreseeable project in this EIS.

5.2.4 Additional Activities in the Project Area

In addition to the reasonably foreseeable actions that are distinct potential projects, there are more generally defined possible actions in the project area which may contribute to cumulative impacts. As further described below, such actions may include activities on the Tumacacori Ecosystem Management Area (EMA) of the Coronado National Forest; an increase in U.S. Border Patrol operations, illegal immigrants, and smuggling; an increase in residential development in the project vicinity; and local initiatives to protect biological and cultural resources. To the extent that the potential environmental impacts of each of these possible activities can be identified, they are included in the cumulative impact analysis that follows.

Activities on the Coronado National Forest. Reasonably foreseeable actions in the Tumacacori EMA of the Coronado National Forest include livestock grazing; activities managed as special uses; other land use; off-road vehicle use (including use of unclassified roads, or roads that are not managed as part of the USFS transportation system); U.S. Border Patrol operations, illegal immigrants, and smuggling, and proposed wilderness designation in portions of the Tumacacori and Atascosa Mountains (see sub-section below).[1]

A large portion of the Tumacacori EMA (an estimated 164,000 acres [66,400 hectares (ha)]) is classified by USFS as able to support livestock grazing, and some is currently under permit for livestock grazing. A majority of this capable rangeland is in satisfactory condition (a USFS measure of the health of the vegetation and soil relative to their combined potential to produce a sound and stable biotic community) (USFS 2001b).

Off-road vehicles are used by visitors to the Tumacacori EMA in areas such as the west side of the Tumacacori Mountains (north of Ruby Road), and to a lesser extent in Peck Canyon. Off-road vehicle use occurs on both USFS system roads (for example, dirt roads for use by high-clearance vehicles such as Level 2 roads, as described in Section 4.12) and on unclassified roads (USFS 2002a).

USFS manages the Coronado National Forest for sustained multiple use of forest and rangeland resources including fuel wood, grazing, recreation, and mining (USFS 2001a). USFS issues special use permits for a wide range of activities, including but not limited to, outfitter and guide operations, to research permits and permits for utilities on the Coronado National Forest.

In 2003, a coalition of organizations, businesses, and landowners known as the Friends of the Tumacacori Highlands began developing a Federal legislative proposal to designate a large portion of the Tumacacori EMA as wilderness (Friends of the Tumacacori Highlands 2004). This group maintains that the area is eligible for wilderness designation and protection because: "the large, remote roadless lands offer visitors a unique opportunity to hike, hunt, and explore one of Arizona's remaining true wildlands. Home to magnificent species such as the jaguar, elegant trogon, and Chiricahua leopard frog, in addition to hosting a great diversity of cultural and historic sites, the Tumacacori Highlands are now threatened by off-road vehicle use and impacts from an expanding population . . ." (Friends of the Tumacacori Highlands 2004). The proposal would double the existing Pajarita Wilderness south of Ruby Road from 7,529 acres (3,047 ha) to 15,931 (6,447 ha) acres and create an entirely new wilderness area of 76,171 acres (30, 825 ha) north of that road. The Arizona Game and Fish Commission has not taken a position on the wilderness proposal, but it directed the state Game and Fish Department to work with interested parties to analyze all

[1] All known proposed actions anticipated for environmental review that are located in the Tumacacori EMA are published by the Nogales Ranger District in its quarterly Schedule of Proposed Actions.

options available for the area, including possible wilderness designation (Arizona Game and Fish Commission 2004). U.S. Representative Raul Grijalva has stated that he supports the Tumacacori Highlands Wilderness proposal (see comments in CRD).

U.S. Border Patrol Operations, Illegal Immigrants, and Smuggling. The Nogales Station of the U.S. Border Patrol conducts routine surveillance in the vicinity of the U.S.-Mexico border, specifically focused on the area south of Ruby Road between the Pajarita Wilderness and Nogales, mostly within the Tumacacori EMA. U.S. Border Patrol activities generally involve accessing the ridgetops to get an open view of the area. The Border Patrol has indicated that they expect an increase in the amount of patrol operations that will occur in this area. There are plans to expand the current Remote Video Surveillance System (RVSS), consisting of 60- to 80- ft (18- to 24- m) high towers, to the west of Nogales and onto the Coronado National Forest. Two of the proposed RVSS sites are on top of the ridgelines just west of the Mariposa commercial truck gate at State Highway 189 (shown on Figure 5.2-1). The Border Patrol also indicates that the preliminary stages of a road project are underway to construct an east-west road toward the Pĕna Blanca Lake area (USBP 2004).

Regional Residential and Economic Development. Section 3.5, Socioeconomics, documents the growing population of the ROI. This results in increased residential development of Pima and Santa Cruz Counties. For example, a proposed *Specific Plan Amendment* and rezoning have been submitted to the Town of Sahuarita Planning and Zoning Commission to expand an existing subdivision called Rancho Sahuarita by 275 acres (111 ha). The proposed area of expansion is located immediately south of the Pima Mine Road and west of the TEP South Substation (Figure 2.1-1). Of the 275 acres (111 ha) proposed for expansion, 265 acres (107 ha) are presently undeveloped and are proposed to be developed with 1,000 residential units and public facilities (Town of Sahuarita 2004). The Town of Sahuarita's recently updated *General Plan* includes the 275 acres (111 ha) of proposed expansion within a designated Growth Area (intended to encourage a high concentration of uses and a creative mix of uses to maximize the use of development infrastructure and make multi-modal transportation a possibility). If the proposal is approved by the Planning Commissioners, the area would be rezoned from Rural Homestead and Rural Residential to Specific Plan (Pima 2003).

Similarly, an application for rezoning has been submitted to the Pima County Planning Division to develop the southwest corner of the Canoa Land Grant from the Santa Cruz River Resource Conservation Area west to the Land Grant Boundary in Green Valley, Arizona. The proposed area of development is located on the west side of I-19, approximately 0.5 mi (0.8 km) south of the Canoa Ranch Interchange (Figure 2.1-1). The proposed area of rezoning is proposed to be developed with 300 single-family residences. If the proposed rezoning is approved, the 545-acre (221-ha) area would be rezoned from Rural Homestead to Single Residence (Green Valley 2004).

Local Initiatives to Protect Biological and Cultural Resources. There are a number of initiatives in various stages of planning at the local level to protect biological and cultural resources. For example, in December 2001 Pima County incorporated the Sonoran Desert Conservation Plan into the Pima County Comprehensive Plan (Pima 2001), although it has not yet been implemented. The Sonoran Desert Conservation Plan contains six areas of focus: Protection of Critical Habitat; Biological Corridors, Mountain Parks, Riparian Restoration, Historic and Cultural Preservation, and Ranch Land Conservation (Sonoran 2003). In the future, the county plans to apply for a multi-species Habitat Conservation Plan permit under the *Endangered Species Act* (ESA) to allow less specific protections for 55 federally listed species in exchange for habitat protection in the conservation reserve system under the Sonoran Desert Conservation Plan.

An example of an initiative to protect cultural resources is the ongoing process of designating the Santa Cruz River as a National Heritage Site. This process is expected to be completed in 2005. The

significance of this designation is to gain recognition of the area as having a diverse natural and cultural heritage.

5.2.5 Power Plants in Mexico

This section discusses, in general terms, the growth of electricity demand in Mexico, the potential for new power plants, regulation of power plants in Mexico (including coordination between the U.S. and Mexico), potential fuel sources, and associated emissions. Demand for electricity in Mexico has increased steadily over the last decade and is forecast to grow at a rate of 5.6 percent between 2003 and 2012 (EIA 2004). Predicted growth will be faster in industrialized regions, such as the Northeast, Baja California, and the Yucatan Peninsula (the Arizona-Mexico border is not included in these regions). There is a growing need for power in both countries near the border (for example, associated with maquiladoras, or manufacturing plants located near the border). There are two state-owned utilities in Mexico, the largest of which is Comisíon Federal de Electricidad (CFE), that is obligated to supply electricity to most parts of Mexico. In addition, independent power producers (IPPs) are allowed to build and own power generation facilities, such as for exporting power to the United States. The potential projects of IPPs are not as easy to predict as are the centrally planned actions of CFE.

In 2002, Mexico's installed electric power generating capacity was 42.3 gigawatts. In the same year, the country generated an estimated 198.6 billion kilowatthours (Bkwh) of electricity, of which thermal (oil, natural gas, and coal) electricity generation account for 81 percent. Oil-fired power plants accounted for the largest share of Mexico's thermal electricity generation, but many of these plants are being converted to natural gas. According to the Mexican government's Secretary of Energy (Secretaría de Energía or SENER), fuel oil accounted for 49.4 percent of thermal feedstock in 2002. By 2012, natural gas is forecast to account for 63 percent of Mexico's power output while fuel oil's share is expected to drop to 24.2 percent. In 2002, hydropower accounted for 12 percent of Mexico's total electricity generation, followed by nuclear with 4.5 percent and geothermal with 2.5 percent. Mexico also has one wind-power installation in Oaxaca, which generated 0.005 percent of the country's total electricity generation. There are plans to increase Mexico's wind capacity (SENER 2004).

Based on the projected demand growth, CFE plans to add 25,757 MW in generation capacity between 2003 and 2012, of which over half is already under construction. Natural gas is expected to be the primary fuel to be used at new power plants in Mexico.

Based on the projections of the electric sector for 2003-2012, the nearest location to TEP's proposed project for existing or projected power plant construction in Mexico is near Naco, Sonora, approximately 75 mi (121 km) east of Nogales (SENER 2004). Near Naco, Sonora, an approximately 267 MW natural gas-fired, combined-cycle power plant is currently under construction, and SENER projects that an additional 469 MW of capacity will be added to this power plant in approximately 2008.

The primary air pollutants of concern that are directly emitted from natural gas-fired power plants are nitrogen oxides (NO_x) and carbon monoxide (CO). Additional pollutants that can form under certain conditions in the atmosphere from NO_x and other airborne chemicals are ozone and particulate matter. Any of these pollutants would be well dispersed before reaching Nogales, Arizona which is approximately 75 mi (121 km) from Naco, Sonora.

Emissions of NO_x from natural gas-fired power plants are regulated in both Mexico and the U.S., although the allowable emissions level is lower in the U.S. Carbon monoxide emissions from natural gas-fired power plants are regulated in the U.S. but not in Mexico. The U.S. and Mexico have set similar standards (goals) for outdoor, ambient air quality (see a comparison of the National Ambient Air Quality Standards [NAAQS] in Section 5.3.8 below). The PM_{10} (particles with an aerodynamic diameter less

than or equal to 10 microns) standard is exceeded in Nogales, Arizona, and Nogales, Mexico, for each country, respectively. As explained in Section 5.3.8, the U.S. Environmental Protection Agency (EPA) is working with the Mexican government in the Border 2012 program in partnership with other Federal agencies to address environmental issues in the border region. Section 5.3.8 provides an analysis of potential cumulative air quality impacts. No additional analysis of cumulative impacts of power plants in Mexico is appropriate because there is no reasonably foreseeable construction or expansion of power plants in Sonora, Mexico that would have potential cumulative environmental effects with TEP's proposed project.

5.3 CUMULATIVE IMPACTS ANALYSIS

The potential cumulative effects are evaluated both for the period of project construction (anticipated to be 12 to 18 months), and for the post-construction (operation) period of the project. Following the discussion of potential cumulative impacts for each resource area for the entire ROI, additional cumulative impact concerns specific to the Coronado National Forest are discussed. This section concludes with Table 5.4-1 that summarizes the cumulative effects by resource area and notes the differences (if any) in cumulative impacts for the Western, Central, and Crossover Corridors.

The primary cumulative impacts from the combination of TEP's proposed project and other past, present, and reasonably foreseeable actions could affect land use (including recreation), visual resources, biological resources, cultural resources, socioeconomic resources, geology and soils, water resources, air quality, noise, human health and environment, and transportation. As detailed in Chapter 4, the proposed project's impacts to air, noise, water, and socioeconomic resources are minimal, and primarily associated with project construction, thus minimizing the potential for cumulative effects.

5.3.1 Land Use and Recreation

Section 3.1.1 describes the existing land use and land use planning in the ROI. Section 3.1.2 describes the existing recreation and the USFS Recreation Opportunity Spectrum (ROS) tool for recreation planning and management. The Arizona State Parks *Draft 2003 Statewide Comprehensive Outdoor Recreation Plan Outdoor Recreation Analyses* indicates a general increasing trend in outdoor recreation in Arizona, by both Arizona residents and visitors on vacations (SCORP 2003). Recreational activities within the Coronado National Forest are expected to increase due to increased area populations (see Section 3.5, Socioeconomics) and the need to find climatic relief or relief from urban areas. Increases in recreation and land use changes associated with industrial, roadway, and residential growth (as described above) are stress factors on existing land use and recreation opportunities and facilities.

There may be adverse cumulative effects on land use as a result of past, present, and reasonably foreseeable projects. Potential industrial development and residential development would introduce land use changes. The cumulative result of TEP's proposed project combined with other transmission line projects and industrial, roadway, and residential growth could be development of land that is currently either undisturbed or used for other activities such as ranching and recreation. The activities of the U.S. Border Patrol and illegal immigrants may further contribute to disturbance of land that is currently in a relatively natural state. When implemented, the Sonoran Desert Conservation Plan may help in defining and protecting a balance of land uses.

In general, National Forest System lands have historically been less impacted by construction and development than other land because of USFS land management requirements. The cumulative impact of TEP construction outside of National Forest System lands would be part of a larger trend towards development, while construction of the TEP project on National Forest System lands would be in areas less cumulatively impacted by other development (except for other permitted uses).

If multiple projects are under construction simultaneously, an increased amount of land would be used temporarily for construction lay down yards and staging areas. For example, construction of the proposed TEP transmission lines and the potential residential construction would temporarily require land use changes in the ROI.

To the extent that changes in land use occur, areas that are currently used for recreation may no longer be available for recreation, or may provide a different recreation experience due to a more developed setting. Increased access on the Coronado National Forest from multiple projects, especially transmission line projects that require ongoing maintenance access, could accelerate the increase in recreational use of National Forest System lands. The cumulative impact of increased recreational use of National Forest System lands could be a change in aspects of the recreational experience such as remoteness, and a possible need for more facilities for visitor management.

5.3.2 Visual Resources

Section 3.2 describes the existing visual resources in the ROI, and the USFS Scenery Management System (SMS) tool for land management planning related to visual resources. Directly related to the potential for the cumulative impact of development of natural land uses and increased operations of the U.S. Border Patrol, the viewshed of the valleys and mountains between Tucson and Nogales, Arizona would continue to be altered from its natural state. For example, these actions could result in the addition of roads to the ROI. In arid climates such as southern Arizona, the recovery of land from disturbances such as unclassified roads tends to be slow, on the magnitude of years, such that the visual landscape is particularly susceptible to long-term cumulative effects.

The differences in cumulative visual impacts from TEP's proposed corridors would be based on the different visual impacts of each corridor (see Section 4.2). The definition and protection of land uses through the Sonoran Desert Conservation Plan could contribute to keeping cumulative visual impacts of development within designated areas. The introduction of construction equipment and staging areas from multiple projects under construction simultaneously would result in temporary increased visual impacts to the ROI. (Refer also to the discussion of cumulative impacts specific to the Coronado National Forest in Section 5.2.13.)

5.3.3 Biological Resources

Natural habitats and special status species could be impacted by many of the past, present, and reasonably foreseeable future actions. As a result of TEP's proposed project combined with industrial projects, roadway projects, and residential growth, a cumulative development of land that currently provides natural habitat could occur. The activities of the U.S. Border Patrol and illegal immigrants, along with increased recreational use described previously under Land Use, would further contribute to disturbance of land that currently provides natural habitat. The Sonoran Desert Conservation Plan, when implemented, would help in defining and protecting a balance of land uses.

The cumulative impact of disturbance of undeveloped native habitat, as described in Land Use, could result in pressures for animals to find new food sources and habitats, and a potential change in the species composition of the area. Increased access roads from multiple actions could result in increased disturbance of existing vegetation. Overall, within the entire ROI, the cumulative impacts are expected to be minimal given the availability of habitat to support the native species.

Cumulative impacts on biological resources could result in localized modification and fragmentation of habitat. These impacts could result in a decline of biodiversity in the Sky Island Region. Because the majority of the Sky Island habitats are under Federal management (for example, National Forest System

land), any future proposals that have the potential to cause significant impact would be subject to analysis under NEPA.

Potential impacts to special interest species would occur under all of TEP's action alternatives (see Appendices D, E, F, and K). All potential impacts as a result of any of the action alternatives and any future actions involving a Federal decision would be subject to consultation requirements under Section 7 of the ESA. Thus, these actions would be subject to requirements and mitigation outlined by the U.S. Fish and Wildlife Service (USFWS). Therefore, impacts to threatened or endangered species would not accumulate without USFWS review. Likewise, all future actions on land administered by the USFS (for example, roadway development) would require Management Indicator Species analysis, and would not accumulate without USFS review (see Section 4.3.5, Management Indicator Species).

New disturbances from all past, present, and reasonably foreseeable future projects would provide a potential point of entry for invasive species onto the landscape, which could lead to adverse modification of the surrounding ecosystems. Colonization of an invasive species within the ROI would be a significant impact. The potential for introduction and spread of invasive species would be greatest during construction of one or more projects, and would continue to exist during project maintenance activities.

5.3.4 Cultural Resources

Directly related to the cumulative impact of natural land development caused by past, present, and reasonably foreseeable future projects, increased disturbance from multiple actions could result in cumulative adverse impacts to cultural resource sites. In addition to project-related disturbance, the increased accessibility created by new roads built for the project can cause cumulative impacts in the form of increased public visitation, recreational impacts, and vandalism. The U.S. Border Patrol stated that the roads associated with the construction and maintenance of the proposed project would contribute to an increase in illegal immigrant and narcotic smugglers in the area and affect U.S. Border Patrol operations. Increased vehicle and foot traffic related to illegal traffic and interdiction could cause damage to cultural resources. Special care would need to be taken to address these cumulative impacts with appropriate mitigation or evaluation measures.

In addition, Tribal representatives listed in Table 3.4–1 have expressed that they value the project area's natural landscape. The cumulative impact on the area landscape from multiple projects would be greater than from the TEP project alone, and would likely evoke a similar concern.

5.3.5 Socioeconomics

Section 3.5 describes the existing socioeconomic resources in the ROI, including population and housing, employment and income, community services, revenues for Forest-based activities, and tourism. As noted in Section 5.3.1 above, to the extent that changes in land use occur, areas that are currently used for recreation may no longer be available for recreation, or may provide a different recreation experience due to a more developed setting. Combined with the potential for other energy projects; industrial and residential development; and increased smuggling and illegal immigration, the cumulative impact could be a reduction in tourism revenue particularly associated with visits to outdoor natural tourist attractions. On the other hand, to the extent that local initiatives to protect biological and cultural resources are implemented (which may serve to protect the resources of outdoor natural tourist attractions), potential cumulative negative impacts on tourism revenue may be reduced.

In addition, future economic development in the region could bring economic benefits to Pima and Santa Cruz Counties. Improvements in roadways have the potential to significantly impact the economy of the border region near Nogales, leading to the creation of more jobs and revenue for the region. Improved

electricity reliability in the Nogales region would be expected to contribute to long-term socioeconomic benefits by supporting business development and regional growth. The cumulative result of TEP's proposed project combined with industrial, roadway, and residential growth could generate more revenue and employment in both counties during and following their construction. However, any cumulative growth effect could also have the potential to stress community resources such as schools, police, and fire protection.

5.3.6 Geology and Soils

Section 3.6 describes the existing geology and soils in the ROI. Directly related to the potential for the cumulative impact of development of natural land uses, activities of the U.S. Border Patrol and illegal immigrants (including unclassified road creation and use), and off-road vehicle use, cumulative adverse impacts to soil resources could result from an increased area of disturbance for construction of multiple projects. These cumulative impacts would be similar to the potential impacts described in Section 4.6.2, Soils, but over a larger area of disturbance. These impacts include an increased potential for erosion and soil compaction from large equipment, and from decreased vegetation cover resulting from off-road vehicle use and clearing of proposed roads and ROWs where necessary. Specifically, illegal immigrant and U.S. Border Patrol activities in Sycamore Canyon and the Pajarita Wilderness adjacent to the U.S.-Mexico border, when combined with TEP's proposed Western Corridor, could result in increased erosion in the Sycamore Canyon Watershed. The contribution to this impact from TEP's proposed project would be minimal because best management practices (BMPs, see Section 4.6.2, Soils) would be employed by TEP for their proposed project. Construction of TEP's proposed project along the EPNG pipeline ROW would minimize the new area of soil disturbance.

5.3.7 Water Resources

Section 3.7 describes the existing water resources in the ROI, and the classification of the watersheds and surface waters in the Tumacacori EMA. The cumulative result of TEP's proposed project combined with other industrial, roadway, and residential growth could be an increase of water use in the ROI. This potential short-term impact would be greatest if multiple projects were constructed simultaneously, as water would be used for dust control and other purposes. In the long term, operation of transmission lines requires little if any water, so would not contribute to a cumulative long-term increase in water demand from potential residential and industrial growth.

In addition, the potential for increased erosion from the proposed project, activities of the U.S. Border Patrol and illegal immigrants (including unclassified road creation and use), and off-road vehicle use, as described above in Section 5.2.6, could negatively impact watershed conditions (explained in Section 3.7.1). Specifically, if the Western Corridor is implemented, the existing watershed quality, condition, and function in the Pajarita Wilderness and Sycamore Canyon (a perennial surface water currently classified as satisfactory) could be adversely affected. If the Central or Crossover Corridors are implemented, the portion of these corridors south of Ruby Road (which has Satisfactory water quality and watershed function) may have cumulative impacts that could affect this classification. In addition, the watershed condition in Peck Canyon (a perennial surface water currently classified as satisfactory) overlapping the Crossover Corridor could have cumulative impacts that could affect this classification. However, as noted above, the contribution to watershed conditions from TEP's proposed project would be minimal because BMPs (e.g., maintain vegetative cover to the extent possible in exposed soil areas during construction activities; minimize exposure of bare soil areas to precipitation following any new construction or other ground disturbing activities for the selected alternative; and slow down stormwater runoff by grading and berms, and provide drainage pathways for runoff) would be employed.

5.3.8 Air Quality

Section 3.8 describes the existing air quality in the ROI. With respect to the NAAQS, Pima and Santa Cruz Counties are designated as being in attainment or unclassifiable for all criteria pollutants, with the exception of the Nogales area in Santa Cruz County, which is designated as a moderate non-attainment area for PM_{10}. Pollutants from a number of sources including motor vehicles, power plants and industrial facilities, agricultural operations, mining, dust from unpaved roads, and open burning of trash have affected urban and regional air quality along the U.S.-Mexico border. The most common and damaging pollutants from these sources include sulfur dioxide, suspended particulate matter (PM-10 and PM-2.5), nitrogen dioxide, ground-level ozone, and carbon monoxide.

Under a bilateral agreement with Mexico signed in 1983 (officially: The 1983 Agreement on Cooperation for the Protection and Improvement of the Environment in the Border Area; hereafter, this agreement will be referred to as the "La Paz Agreement"), the United States and Mexico have developed and implemented a series of strategies to address environmental issues along their shared border. The La Paz Agreement is the legal basis for the Border 2012 Program, which has the stated mission, "To protect the environment and public health in the U.S.-Mexico border region, consistent with the principles of sustainable development."

With respect to air quality, the Border 2012 Program has two major objectives:

(1) By 2012 or sooner, reduce air emissions as much as possible; and

(2) By 2003, define baseline and alternative scenarios for emissions reductions along the border, and their impacts on air quality and human exposure.

Consistent with the Border 2012 Program, the United States and Mexico currently operate coordinated air monitoring networks, compile emission inventories, and conduct modeling analyses designed to support reasonable pollution control strategies to achieve national air quality standards on both sides of the border. One example resulting from this cooperative agreement is the U.S.–Mexico Border Information Center on Air Pollution (see http://www.epa.gov/ttn/catc/cica/geosel_e.html for more information).

Although substantial gains have been made, air quality is still a major concern throughout the border region. The pressures associated with industrial and population growth, the increase in the number of old vehicles, differences in governance and regulatory frameworks, and topographic and meteorological conditions present a challenging context in which to address air quality management. These same factors also present many opportunities for bi-national cooperation.

Table 5.3.8-1 lists the air quality standards for the U.S. and Mexico. The table includes the time period over which pollutant concentrations are averaged (*i.e.*, exposure time), and the numerical value of each standard. Values are in parts per million by volume (ppm) and micrograms per cubic meter of air ($\mu g/m^3$).

Table 5.3.8-2 depicts the current air quality data for the Mexico-U.S. border region near Nogales. As shown on that table, no pollutants exceed any air quality standards. The cumulative impact of TEP's proposed project combined with other industrial, roadway, and residential growth, and activities of the U.S. Border Patrol and illegal immigrants could be an increase in airborne dust and vehicle emissions within the ROI. This potential impact would be greatest if multiple projects were constructed simultaneously due to the potential for airborne dust generation. An additional source of air pollutants in the U.S. could be wind transport of airborne dust or pollutants from Mexican transmission line or roadway construction activities in or near Nogales, Mexico. Construction vehicle emissions (as described in Section 4.8) would be greatest if multiple projects were constructed simultaneously, but would tend to

dissipate within a few days rather than accumulate in the air over time. In the long term, operation of transmission lines generates very little air emissions, so it would not contribute to a cumulative increase in air emissions. No cumulative impacts to the ROI's attainment status under the NAAQS are expected. With respect to the 267 MW natural gas-fired, combined-cycle power plant that is currently under construction in Naco, Sonora, any pollutants from this plant would be well dispersed before reaching Nogales, Arizona, which is approximately 75 mi (121 km) from Naco, Sonora.

5.3.9 Noise

Section 3.9 describes the existing noise environment in the ROI. The cumulative result of TEP's proposed project combined with other transmission line projects, and industrial, roadway, and residential growth could be an increase in noise levels during periods when construction projects occur simultaneously. Cumulative noise impacts would be short term and limited to daylight hours. No long-term cumulative noise impacts would occur.

5.3.10 Human Health and Environment

No Federal regulations have been established specifying environmental limits on the strengths of electric and magnetic fields (EMFs) from electric transmission lines. The cumulative impacts to human health and safety could be an increase in background EMF exposure to residents in the immediate vicinity of overlapping transmission line projects (for example, by TEP and PNM). Section 4.10 gives example EMF exposures of two 345-kV transmission lines operating adjacent to one another (on BLM land, in this case). The EMF levels in this example at a distance where residences would potentially be located are well below 0.8 milligauss (mG), the average daily exposure to maximum magnetic fields from some common household appliances (NIEHS 1999). While extensive research has been conducted to determine if exposure to electric or magnetic fields may cause or promote adverse health effects, the National Institute of Environmental Health Sciences (NIEHS) concluded that "The scientific evidence suggesting that ELF-EMF exposures pose any health risk is weak" and that "The probability that EMF exposure is truly a health hazard is currently small" (NIEHS 1999). Based on an assessment such as this, no long-term cumulative human health impacts are expected to occur. However, the subject remains controversial (see Appendix B).

Table 5.3.8-1. Health-Based Ambient Air Standards

POLLUTANT	STANDARD	
	United States	Mexico
Carbon monoxide (CO)		
8-hour Average	9 ppm	11 ppm
1-hour Average	35 ppm	
Nitrogen dioxide (NO_2)		
Annual Average	0.053 ppm	
1-hour Average		0.21 ppm
Ozone (O_3) (See note)		
8-hour Average	0.08 ppm	
1-hour Average	0.12 ppm	0.11 ppm
Sulfur dioxide (SO_2)		
Annual Average	0.030 ppm	0.030 ppm
24-hour Average	0.14 ppm	0.13 ppm
Particulate matter smaller than 2.5 micrometers ($PM_{2.5}$)		
Annual Average	15 $\mu g/m^3$	
24-hour Average	65 $\mu g/m^3$	
Particulate matter smaller than 10 micrometers (PM_{10})		
Annual Average	50 $\mu g/m^3$	50 $\mu g/m^3$
24-hour Average	150 $\mu g/m^3$	150 $\mu g/m^3$
Total suspended particulate matter (TSP)		
Annual Average		75 $\mu g/m^3$
24-hour Average		260 $\mu g/m^3$
Lead (Pb)		
Quarterly Average	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$

Source: Source: Technology Transfer Network, U.S.-Mexico Border Information Center on Air Pollution; http://www.epa.gov/ttn/catc/cica/
Note: EPA is phasing out the U.S. 1-hour ozone standard and replacing it with an 8-hour standard that is more protective against longer-duration exposures to the pollutant.

Table 5.3.8-2. Border Air Quality Data – Monitor Values Report

Geographic Area: Nogales
Pollutant: Carbon Monoxide, Nitrogen Dioxide, Ozone, Sulfur Dioxide, Particulate (diameter <2.5 micrometers), Particulate (diameter <10 micrometers), Lead, Total Suspended Particulate
Year: 2004
EPA Air Quality Standars:
Carbon Monoxide: 35 ppm (1-hour average), 9 ppm (8-hour average)
Nitrogen Dioxide: 0.053 ppm (annual mean)
Ozone: 0.12 ppm (1-hour average), 0.08 ppm (8-hour average)
Sulfur Dioxide: 0.5 ppm (3-hour average), 0.14 ppm (24-hour average), 0.030 ppm (annual mean)
Particulate (diameter < 2.5 micrometers): 65 µg/m3 (24-hour average), 15.0 µg/m3 (annual mean)
Particulate (diameter < 10 micrometers): 150 µg/m3 (24-hour average), 50 µg/m3 (annual mean)
Lead: 1.5 µg/m3 (quarterly mean)
TSP: No EPA Standard
ppm = parts per million µg/m3 = micrograms per cubic meter

CO (ppm)		NO2 (ppm)	O3 (ppm)		SO2 (ppm)		PM2.5 (µg/m3)		PM10 (µg/m3)	
1-Hour Value	8-Hour Value	1-Hour Value	1-Hour Value	8-Hour Value	24-Hour Value	Annual	24-Hour Value	Annual	24-Hour Value	Annual
Max		Max	Max		Max	Mean	Max	Mean	Max	Mean
			0.080	0.073						
5.5	3.7		0.076	0.070						
									37	14
							17	6.2	119	29
			0.081	0.075						
									149	33
									50	29
3.4	1.4	0.059	0.078	0.073	0.003	0.001				
4.0	1.8									
			0.075	0.069					23	14
			0.078	0.071						
4.0	2.7									
									30	22
									37	22
2.2	1.4	0.063	0.077	0.071			10	5.9		
							12	6.9		
			0.075	0.071					127	15

Source: Technology Transfer Network, U.S.-Mexico Border Information Center on Air Pollution; http://www.epa.gov/ttn/catc/cica/

5.3.11 Transportation

Section 3.12 describes the existing transportation system in the ROI. As described in Section 5.2.4 above, off-road vehicles are used by visitors to the Tumacacori EMA, and a significant portion of off-road vehicle use in the project vicinity may be on unclassified roads. In addition, the Nogales Station of the U.S. Border Patrol conducts routine surveillance in the vicinity of the U.S.-Mexico border, specifically focused on the area south of Ruby Road between the Pajarita Wilderness and Nogales, mostly within the Tumacacori EMA. U.S. Border Patrol activities generally involve accessing the ridgetops to get an open view of the area. The Border Patrol has indicated that they expect an increase in the amount of patrol operations that will occur in this area.

The cumulative result of TEP's proposed project combined with other industrial, roadway, and residential growth, and activities of the U.S. Border Patrol and illegal immigrants could be a cumulative development of more roadways for project access and private and commercial use. The activities of the U.S. Border Patrol and illegal immigrants may further contribute to the development of new roadways and paths, which would be unclassified roads by default, although the U.S. Border Patrol has indicated that they are working with USFS to formally acknowledge and address the roads used by the U.S. Border Patrol. This change in land use has implications for a number of resources areas as previously described. In addition, multiple simultaneous construction projects could result in a temporary increase in traffic congestion. The TEP proposed project includes corridors with a segment on the Coronado National Forest, and would require construction and ongoing maintenance access on National Forest System lands. Construction of TEP's proposed project along the EPNG pipeline ROW would minimize the need for new project access. Cumulative traffic impacts would be short-term and limited to daylight hours. No long-term cumulative traffic impacts would occur. Multiple simultaneous construction projects could result in a temporary increase in traffic congestion and traffic accidents and a decrease in worker safety. No long term cumulative traffic impacts would occur.

5.3.12 Environmental Justice

The proposed project would not result in any disproportionately high and adverse impacts for the minority or low-income population, as described in Section 4.13. No means were identified for minority or low-income populations to be disproportionately affected, and the proposed project would not contribute cumulatively to any environmental justice impacts.

5.3.13 Additional Cumulative Impact Concerns Specific to the Coronado National Forest

In addition to the potential cumulative impacts described above for each resource area, which include impacts on National Forest System lands, the following discusses issues specific to the Coronado National Forest. The cumulative impacts from increased road access into any TEP corridor on the Coronado National Forest, combined with other past, present, and reasonably foreseeable projects, have the potential to adversely affect biological resources, visual resources, cultural resources, land use, and soil.

Cumulative adverse impacts to cultural resources could result from increased disturbance for construction of multiple projects that could disturb currently unknown cultural resource sites. Tribal consultations indicate that disturbance to the natural landscape would also be considered an adverse impact to cultural resources. If multiple actions occur, special care would need to be taken to address these cumulative impacts with appropriate mitigation or evaluation measures.

Cumulative adverse impacts to soil resources could also result from an increased area of disturbance for construction of multiple projects. These cumulative impacts would be similar to the potential impacts

described in Section 4.6.2, Soils, but over a larger area of disturbance. These impacts include an increased potential for erosion and soil compaction from large equipment, and from decreased vegetation cover resulting from clearing of proposed roads and the ROW where necessary.

Recreational activities within the Tumacacori EMA are expected to increase due to increased area populations (see Section 3.5, Socioeconomics) and the need to find climatic relief or relief from urban stress. Increased access from multiple projects, especially transmission line projects that require ongoing maintenance access, could accelerate the increase in recreational use of National Forest System lands. This could adversely impact natural and cultural resources as described above. The cumulative impact of increasing development on National Forest System lands could be a change in the Recreation Opportunity Spectrum (ROS) settings. By causing a change in access, naturalness, and other ROS setting indicators, the range of possible ROS settings available for recreation could be narrowed.

The cumulative impact of TEP's proposed project and other past, present, and reasonably foreseeable future actions could be a loss over time of land that gives the overall visual impression of being relatively undisturbed by human activities (that is a natural landscape). This change in landscape character (see Section 3.2, Visual Resources) could especially occur in rapidly growing southeastern Arizona. Public lands, such as the Coronado National Forest, are some of the few remaining natural landscapes, and these natural landscapes on National Forest System lands have increasing impacts from development as time goes on. For example, in the neighboring Santa Rita Mountains southeast of Tucson, the Whipple Observatory complex and Melendrez Pass communication site impact otherwise natural lands. Other potential contributors to these cumulative impacts on National Forest System lands include roadways, housing, commercial development, livestock grazing, recreation activities, undocumented immigrant activities associated with the U.S.-Mexico border, mining projects, and other possible activities under special use permits.

5.4 CUMULATIVE IMPACTS ANALYSIS SUMMARY

Based on the reasonably foreseeable actions identified in Section 5.1, and the cumulative impacts analysis in Section 5.2, Table 5.4-1 provides a summary comparison of cumulative impacts by resource area and notes the differences (if any) in cumulative impacts for the Western, Central, and Crossover Corridors.

Table 5.4-1. Summary Comparison of Cumulative Impacts

Resource Area	Cumulative Impact	Major Differences Between the Western, Central, and Crossover Corridors
Land Use	Development of land that is currently either undisturbed or used for other activities such as ranching and recreation. Cumulative impact of TEP construction outside of National Forest System lands would be part of a larger trend towards development, while construction of the TEP project on National Forest System lands would be in areas less cumulatively impacted by other development.	Higher for the Western and Crossover Corridors since mileage through undisturbed areas is greater.
Recreation	Some areas that are currently used for recreation may no longer be available for recreation, or may provide a different recreation experience due to a more developed setting.	Higher for the Western and Crossover Corridors since mileage through undisturbed areas is greater.
Visual Resources	Viewshed of the valleys and mountains between Tucson and Nogales, Arizona would continue to be altered from its natural state. Off-road vehicle use and unclassified road creation and use would continue to contribute significantly to roads that are visible in the landscape.	Higher for the Western and Crossover Corridors, based on the different visual impacts of each corridor (see Section 4.2).
Biological Resources	Disturbance of native habitat could pressure animals to find new food sources and habitats. Localized modification and fragmentation of habitat is possible, and could result in a decline of biodiversity in the Sky Island Region and potential impacts to special interest species.	Higher for the Western and Crossover Corridors, based on greater acreage disturbed, but not significantly different among any action alternatives.
Cultural Resources	Land disturbance from multiple actions could result in cumulative adverse impacts to cultural resource sites. Increased accessibility created by cumulative new development could increase public visitation, recreational impacts, and vandalism.	None.
Socioeconomics	Potential reduction in tourism revenue particularly associated with visits to outdoor natural tourist attractions. Growth in the area could generate more revenue and employment, and stress community services.	None.

Table 5.4-1. Summary Comparison of Cumulative Impacts (*continued*)

Resource Area	Cumulative Impact	Major Differences Between the Western, Central, and Crossover Corridors
Geology and Soils	Increased potential for erosion and soil compaction.	Higher for the Western and Crossover Corridors since the total length of the corridors are longer than the Central Corridor.
Water Resources	Increase of water use in the ROI and negative impact on watershed conditions.	Higher for the Western and Crossover Corridors, based on proximity to Sycamore and Peck Canyons, respectively, since both canyons have perennial surface waters.
Air Quality	Increase in airborne dust and vehicle emissions, but no air quality standards expected to be exceeded.	None.
Noise	Short-term, temporary increase in noise levels during periods when construction projects occur simultaneously.	None.
Human Health and Environment	No long-term cumulative human health impacts are expected to occur. Multiple simultaneous construction projects could result in a temporary increase in traffic congestion and traffic accidents and a decrease in worker safety.	None.
Transportation	Cumulative development of more paths and roadways. Road density of official USFS roads on federal lands would not change.	Highest for the Western and Crossover Corridors since the mileage of new roads needed is greater. However, the cumulative impact on Federal lands would be unaffected because no net new roads would result.
Environmental Justice	No environmental justice impacts.	None.